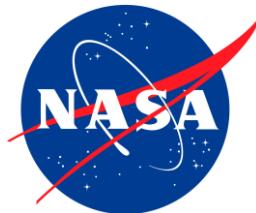


Combined polarimetric Doppler radar and satellite scatterometer observations of organized convection near coastal regions



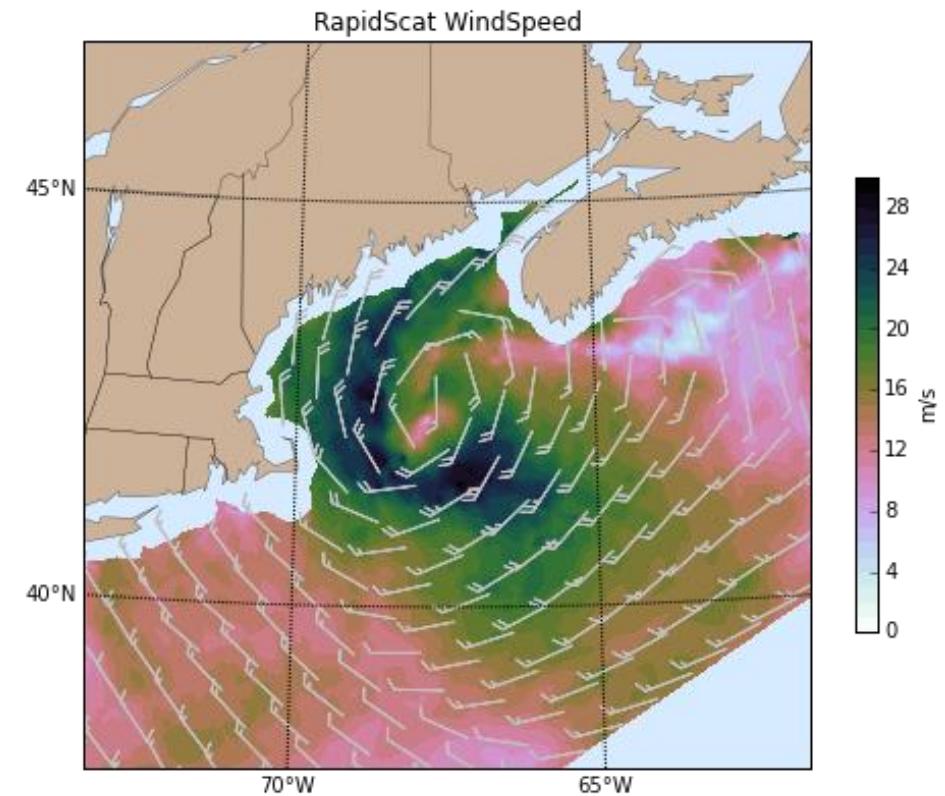
Timothy Lang



George Priftis, Themis Chronis



Piyush Garg, Steve Nesbitt

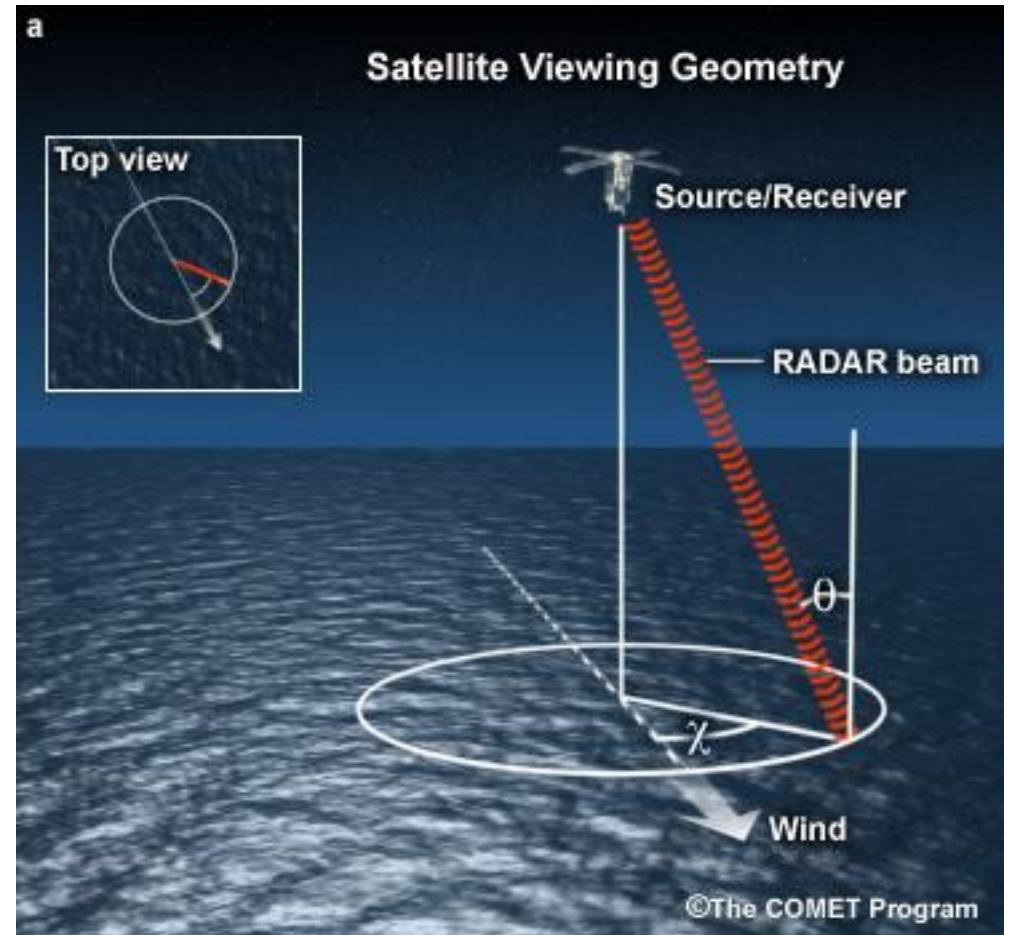


Background

- Scatterometers are radars on satellites that scan the ocean surface at multiple look angles
- Retrieve wind speed and direction via empirical relationships (geophysical model functions) linked to ocean surface state (mean square slope)
- Typically Ku- (e.g., QuikSCAT, RapidScat) or C-band (e.g., ASCAT) - subject to attenuation by rainfall, or spoofing by raindrop-induced surface capillary waves

Our Scientific Questions

- Given limitations of scatterometers in raining areas, how can we best use them to understand near-surface winds in and near organized convective systems?
- What is the value added by combining scatterometry with polarimetric Doppler radars near coastlines/islands?
- Can we identify significant surface wind features (e.g., in/outflow, boundaries, jets, etc.) that may be responsible for organizing convective systems?



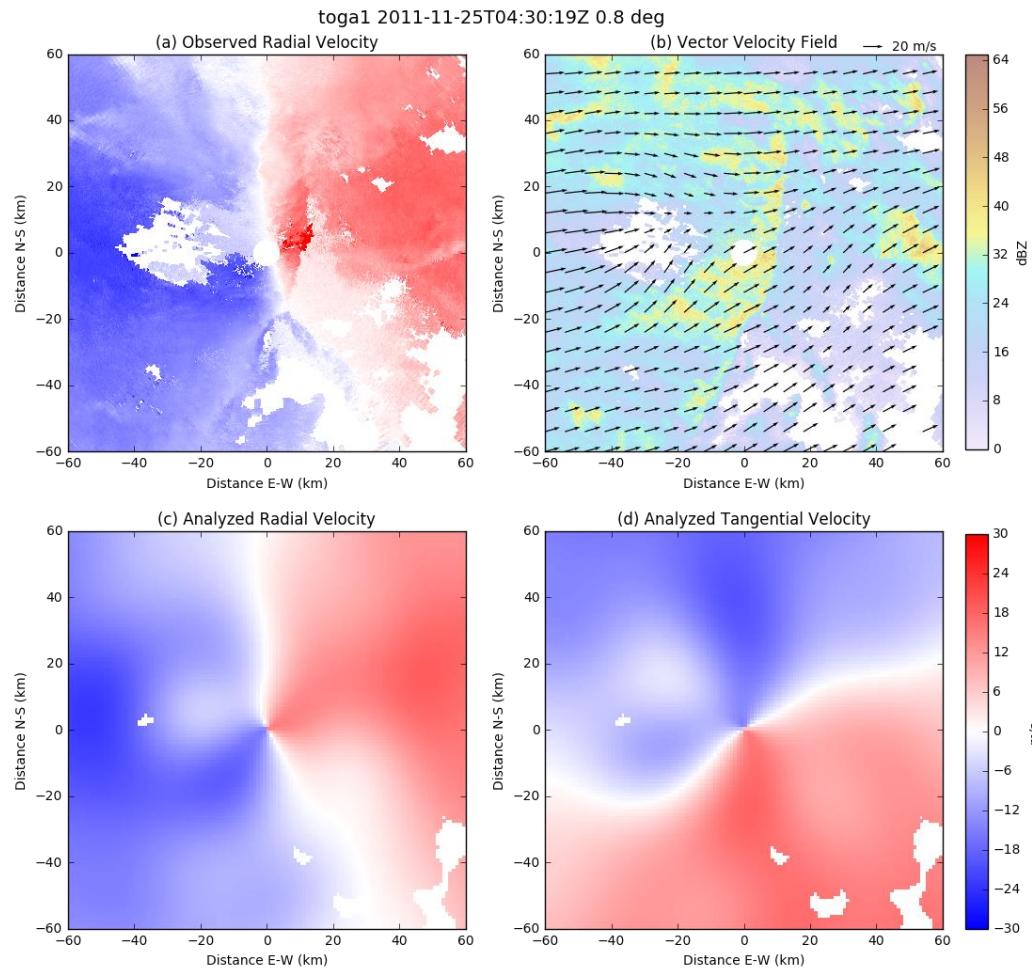
www.goes-r.gov (COMET module)

©The COMET Program

SingleDop

<https://github.com/nasa/SingleDop>

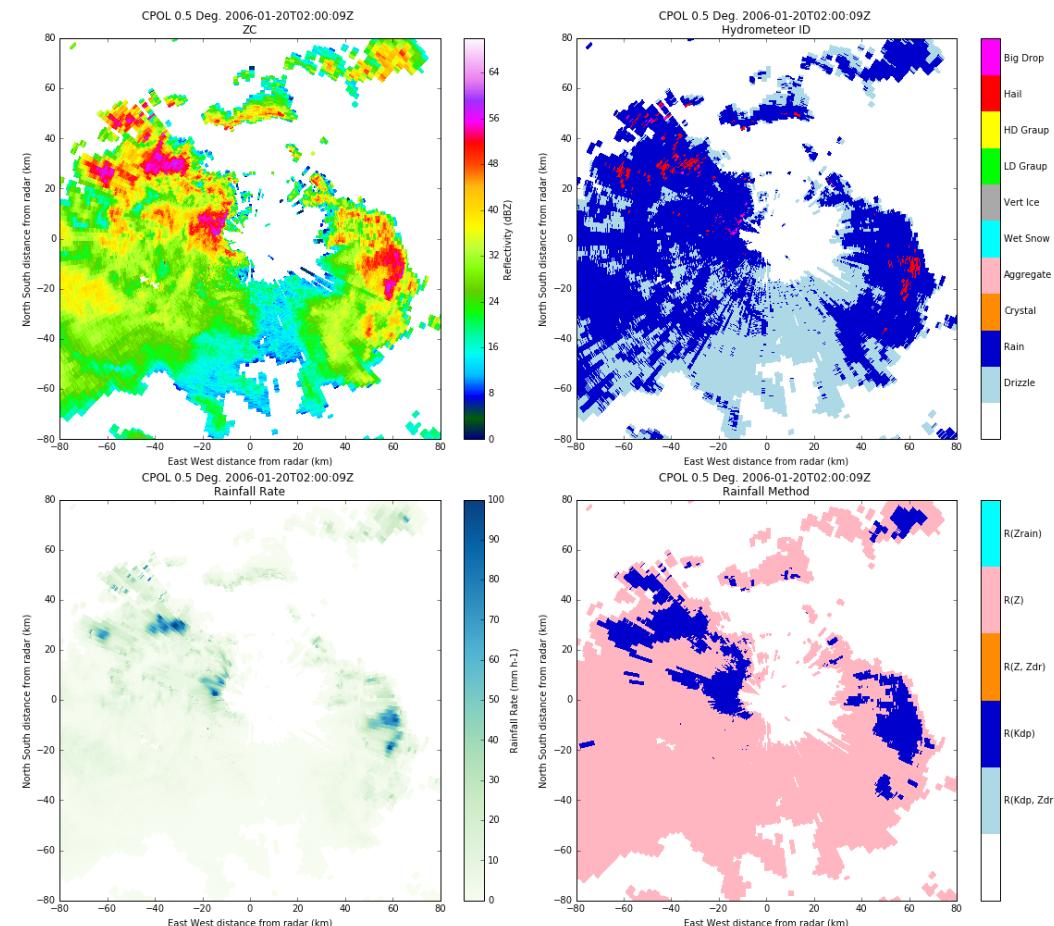
- Single-Doppler retrievals of low-level 2D winds on conical PPI sweep
- Based on Xu et al. (2006) 2DVAR algorithm



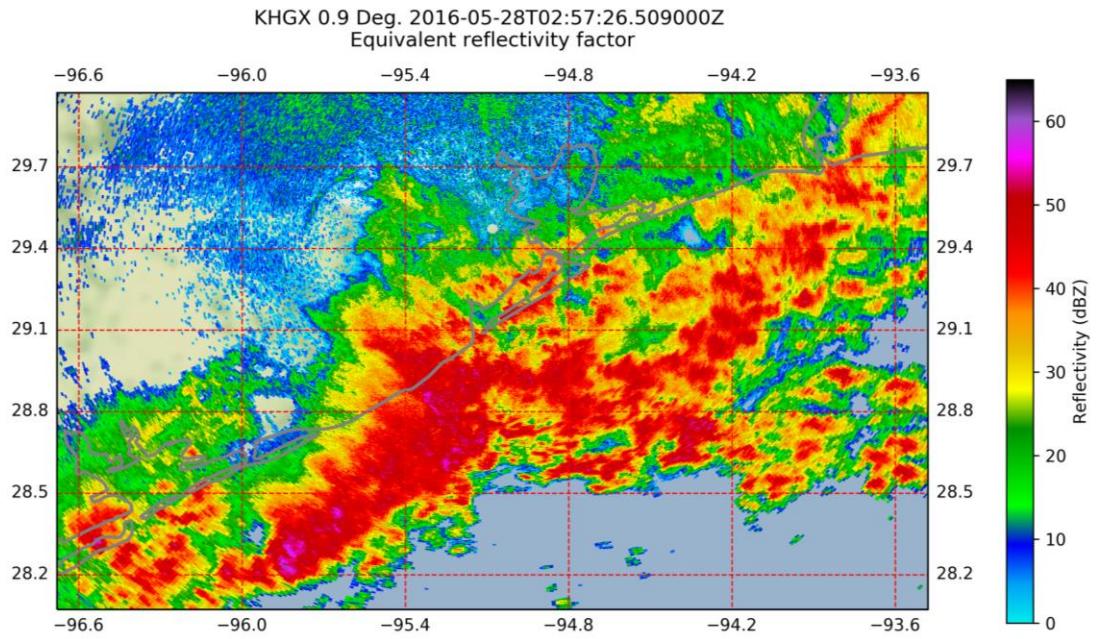
DualPol

<https://github.com/nasa/DualPol>

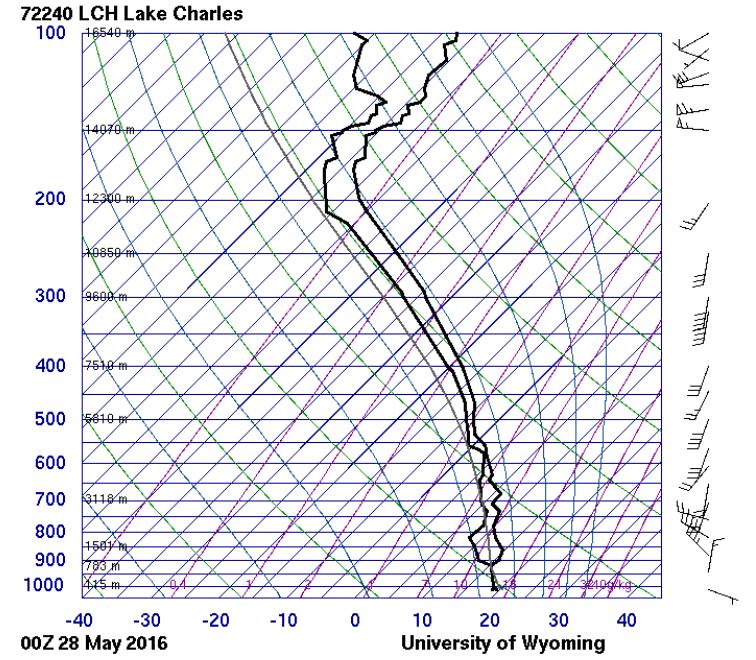
- Dual-pol retrievals from arbitrary radar, including rain, DSD, LWC/IWC, HID, etc.
- Based on CSU algorithm heritage (e.g., Bringi, Chandra, Carey, Cifelli, Dolan, Lang)



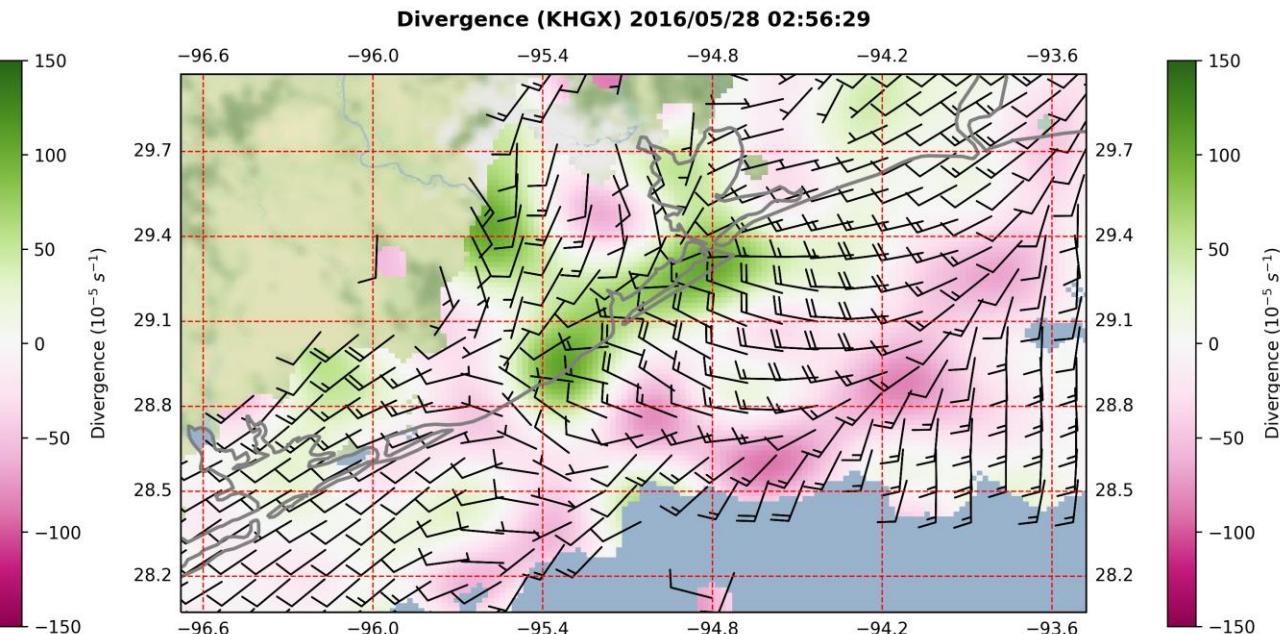
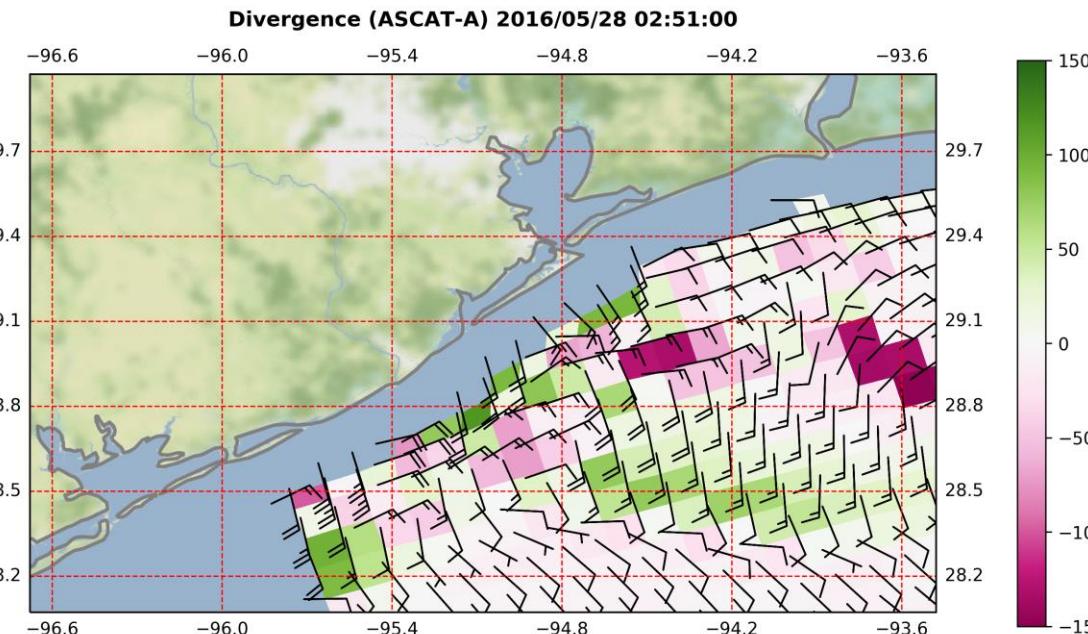
Also – Py-ART, CSU_RadarTools, pyresample, etc.



5/28/2016
Houston

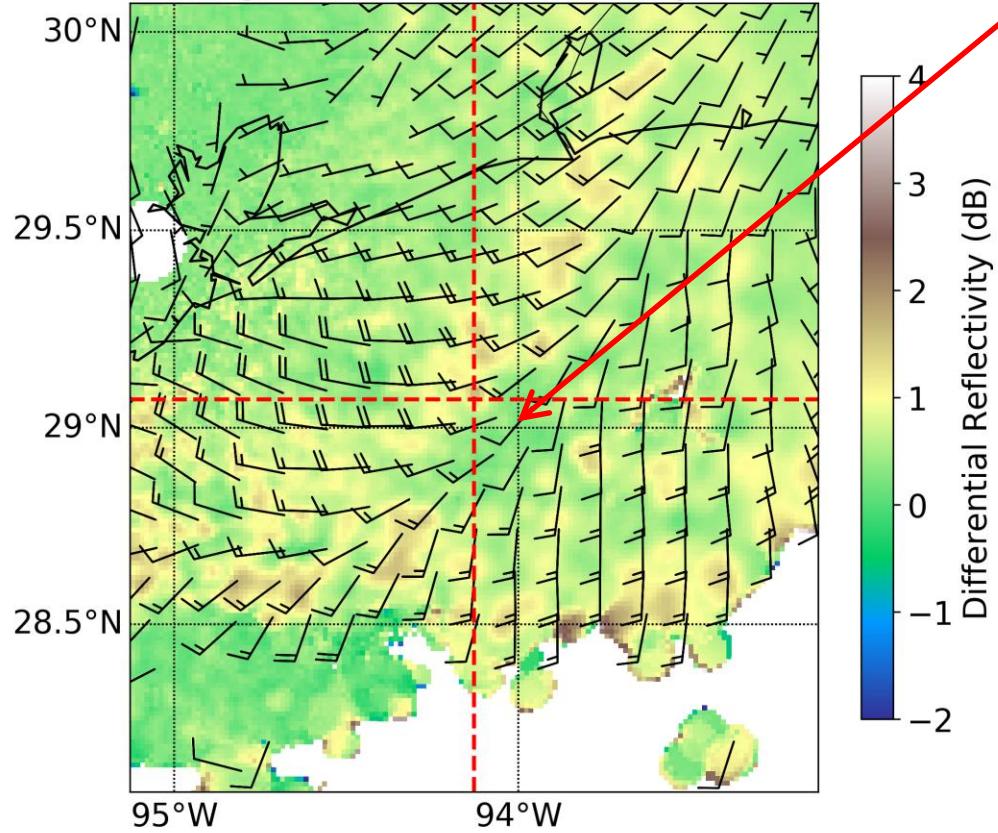


SLAT	30.11
SLON	-93.21
SELV	10.00
SHOW	3.41
LIFT	2.39
LFTV	2.46
SWET	251.4
KINX	31.00
CTOT	18.90
VTOT	22.70
TOTL	41.60
CAPE	0.13
CAPV	0.15
CINS	0.00
CINV	0.00
EQLV	919.8
EQTV	920.0
LFCT	978.0
LFCV	982.8
BRCH	0.00
BRCV	0.00
LCLT	291.0
LCLP	982.8
MLTH	292.5
MLMR	13.34
THCK	5695.
PWAT	48.74

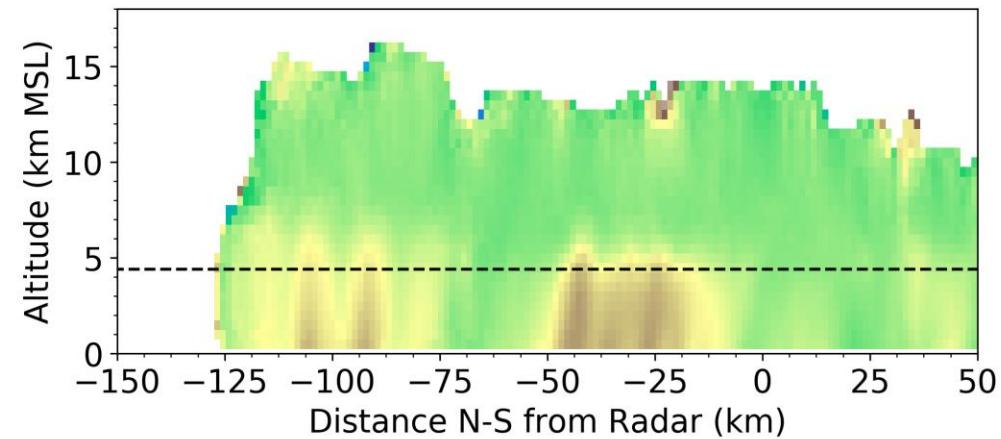
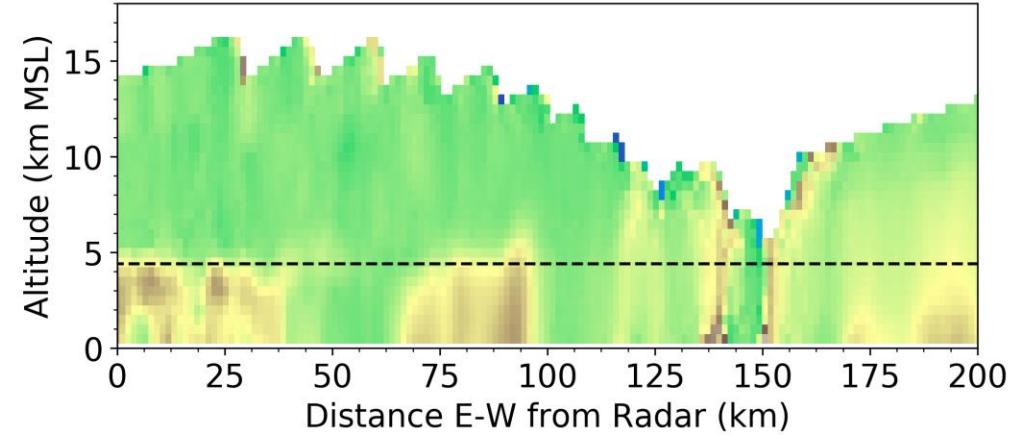


ZDR and SingleDop Winds

KHGX 4.5 km 2016-05-28T02:57:26.509000Z
Log differential reflectivity hv

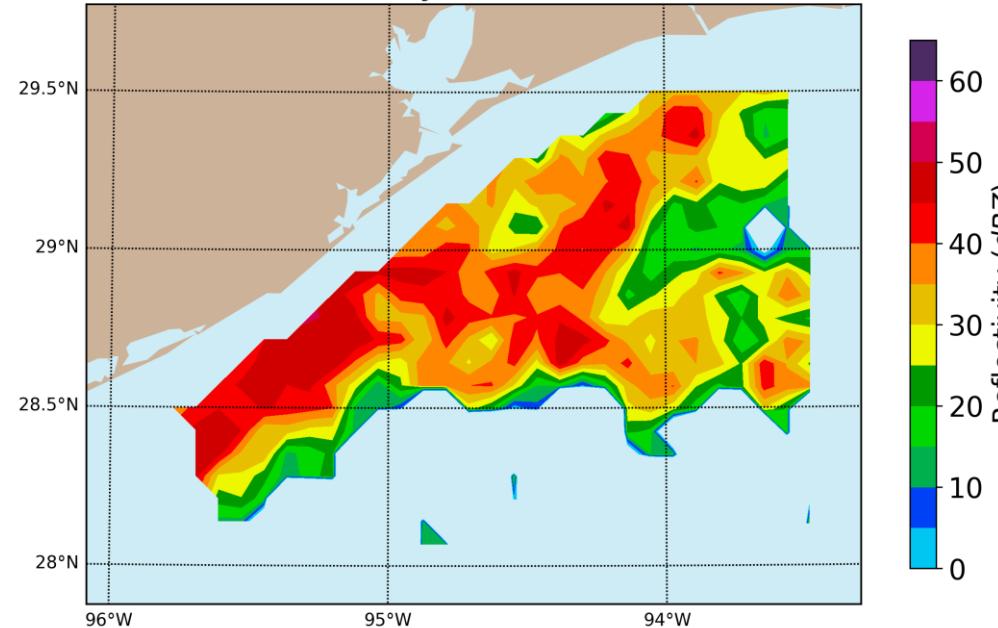


Line of Convergence



ZDR columns reside just rearward of low-level convergence

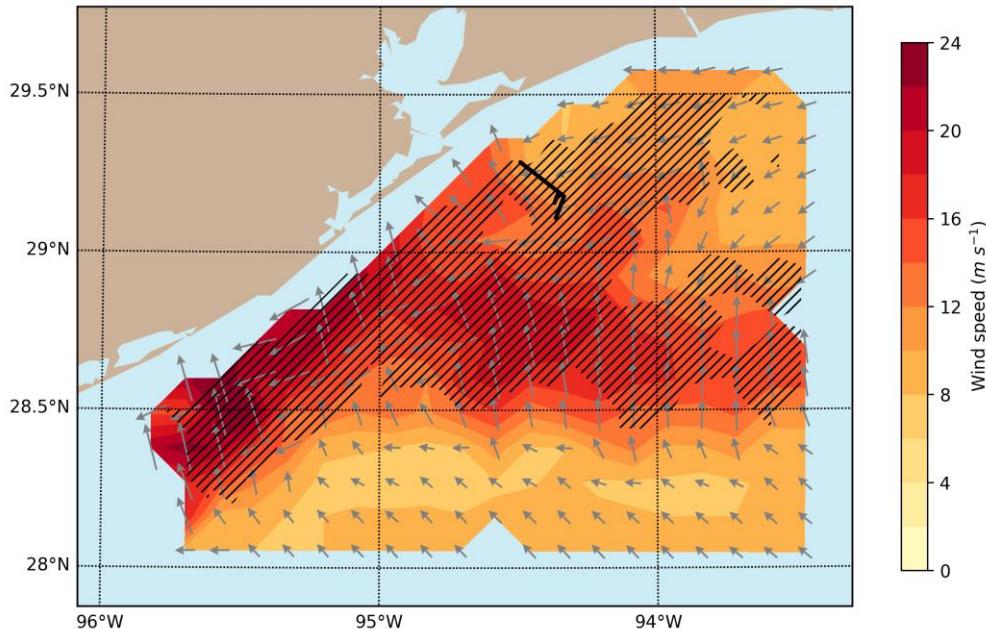
KHGX Reflectivity 2016/05/28 02:56:28



Reflectivity (dBZ)

60
50
40
30
20
10
0

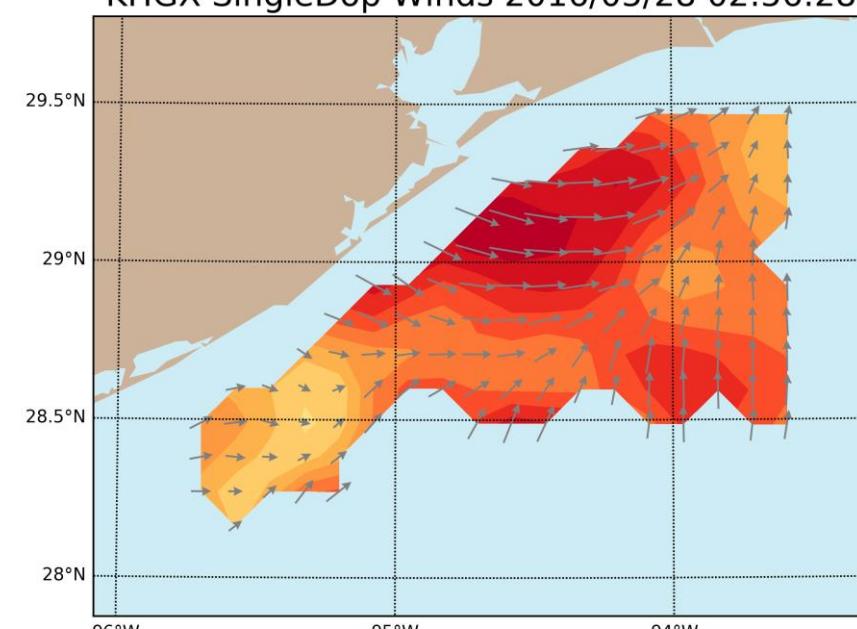
ASCAT-A Winds 2016/05/28 02:51:00



Wind speed (m s⁻¹)

24
20
16
12
8
4
0

KHGX SingleDop Winds 2016/05/28 02:56:28

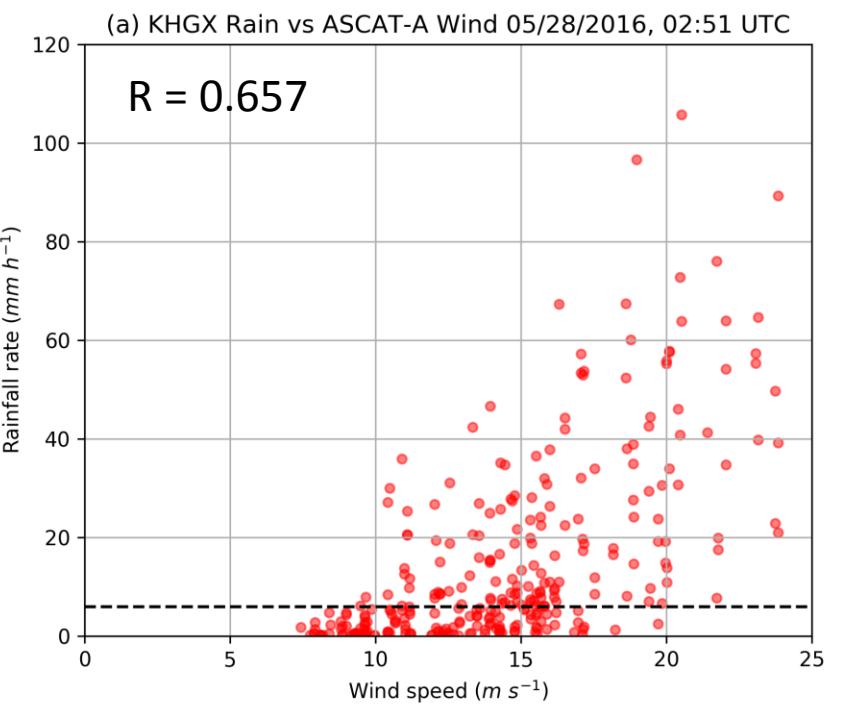


Wind speed (m s⁻¹)

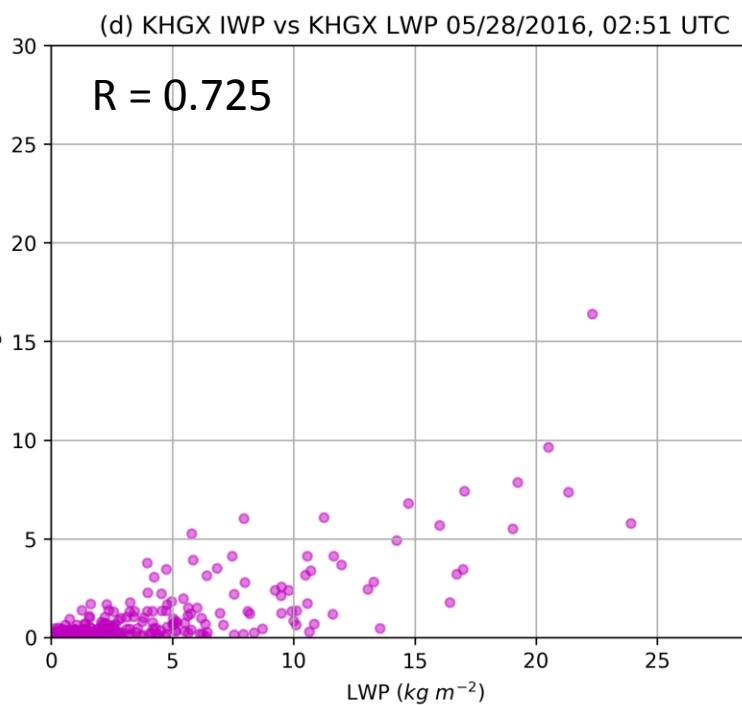
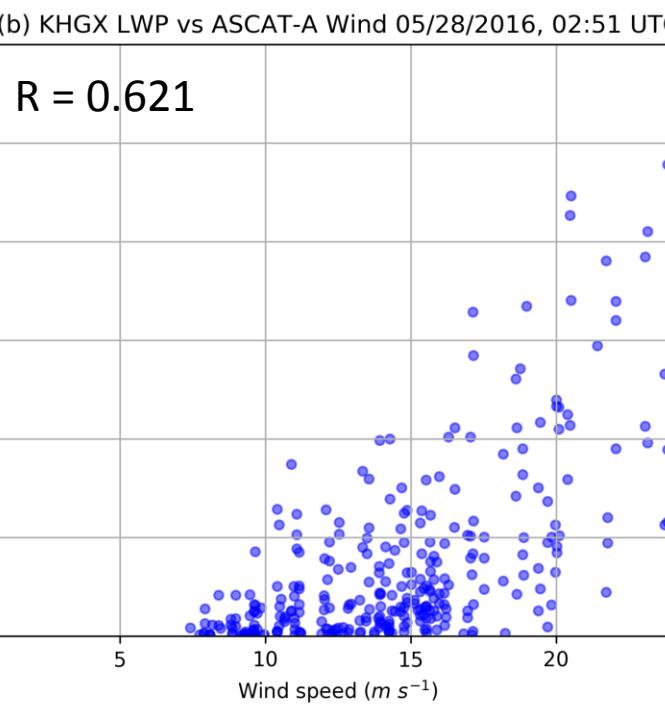
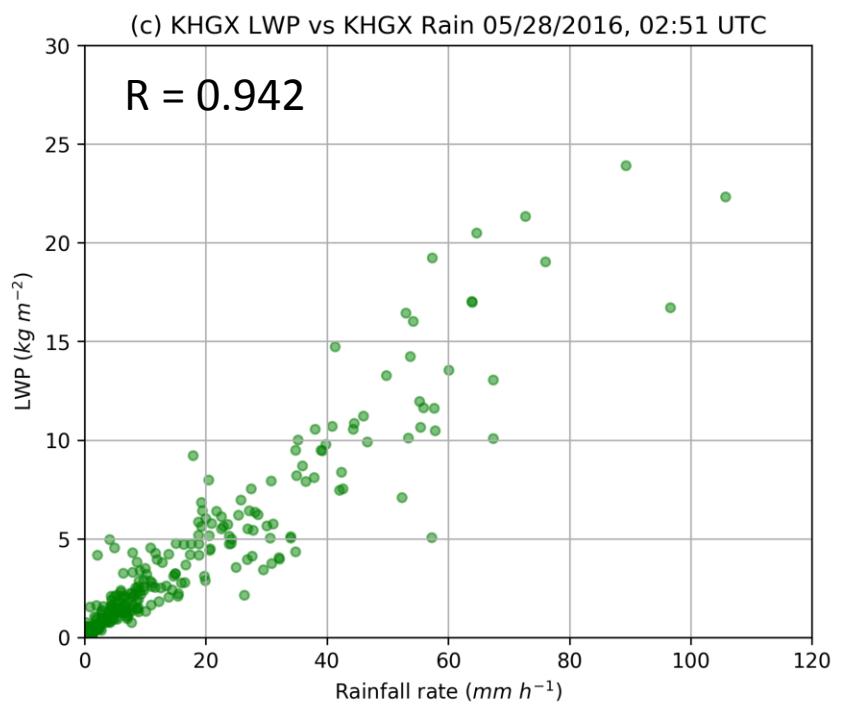
24
20
16
12
8
4
0

Resampled to 12.5-km

KHGX Rain vs. ASCAT-A Wind



KHGX LWP vs. KHGX Rain

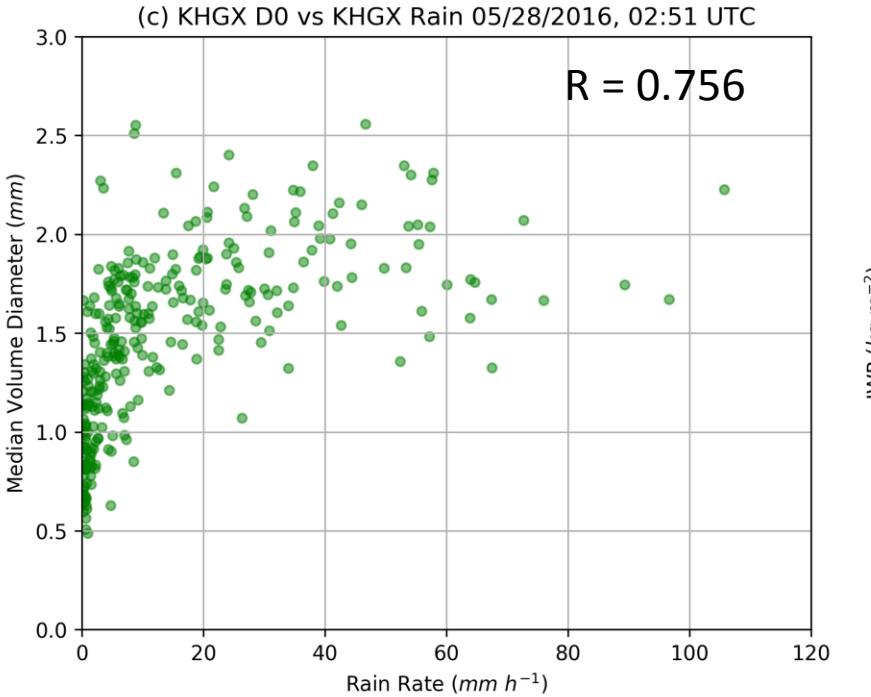


KHGX LWP vs. ASCAT-A Wind

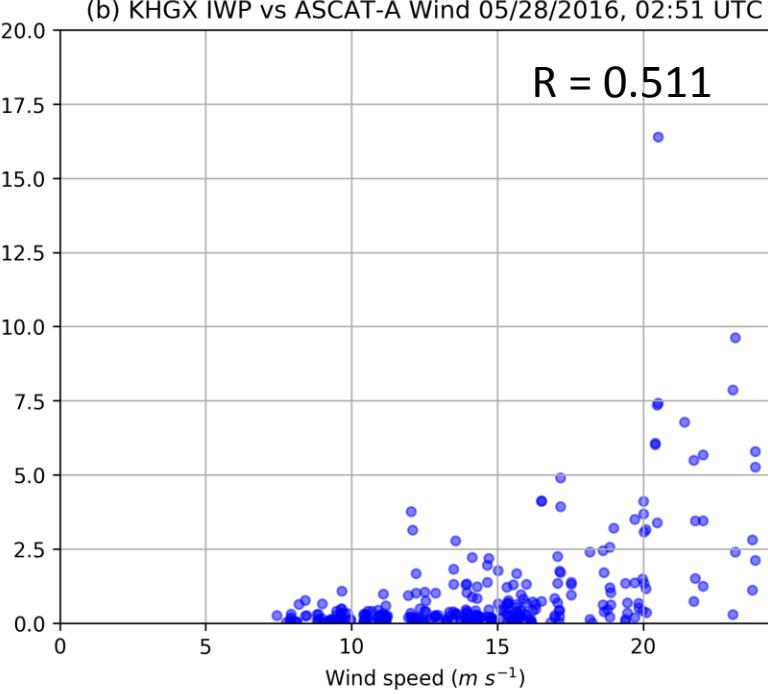
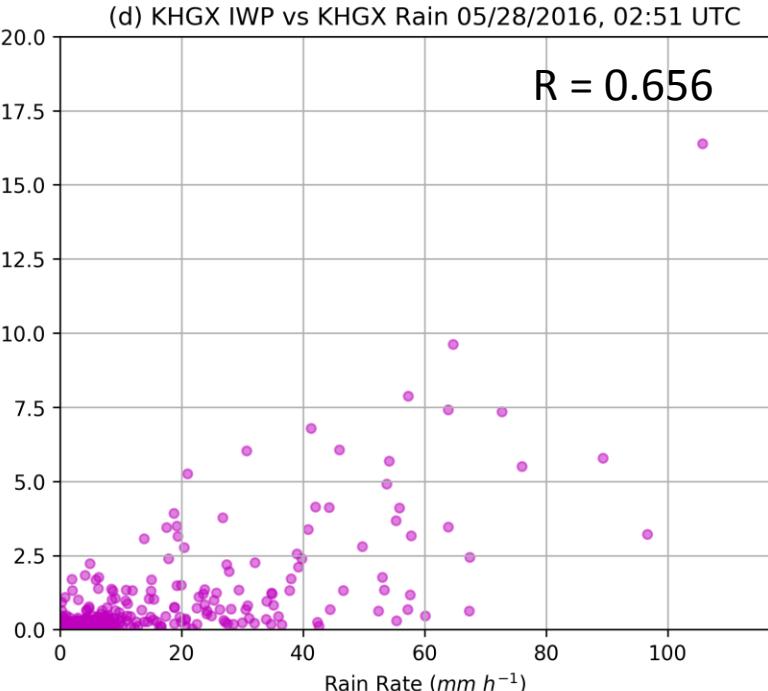
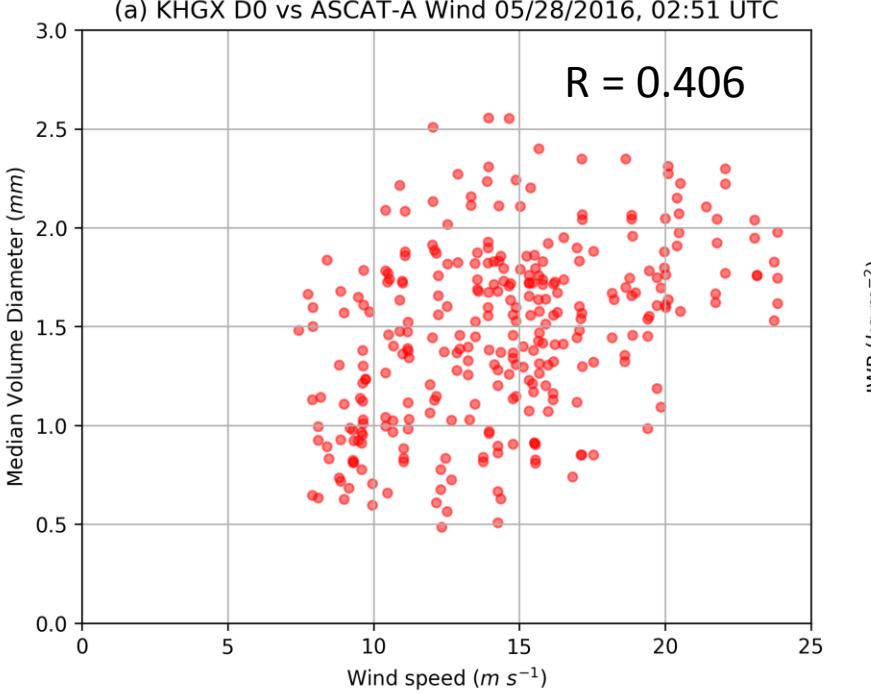
KHGX IWP vs. KHGX LWP

Resampled to 12.5-km

KHGX D₀ vs. Rain



KHGX D₀ vs. ASCAT-A

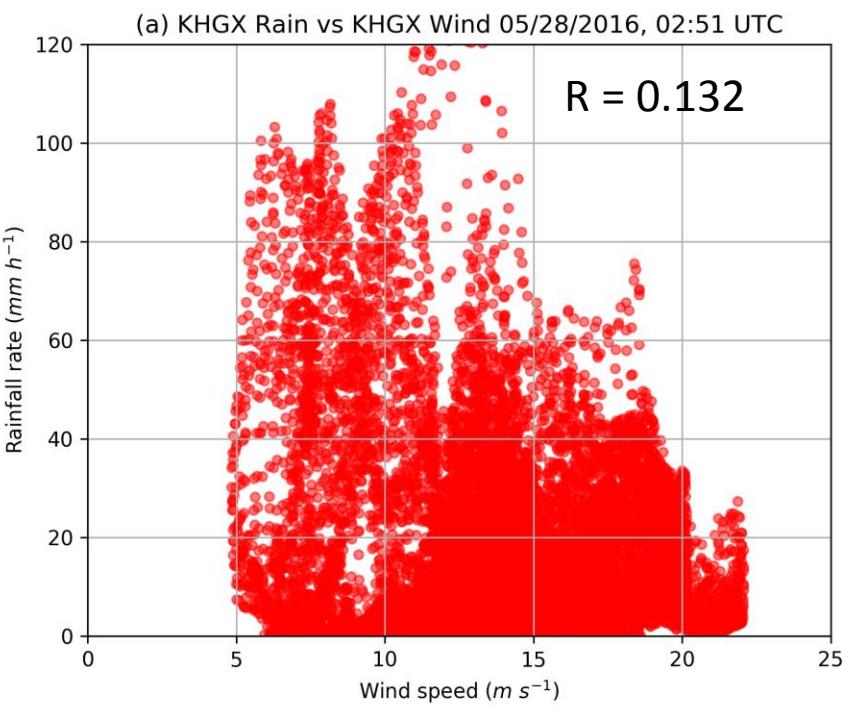


KHGX IWP vs. Rain

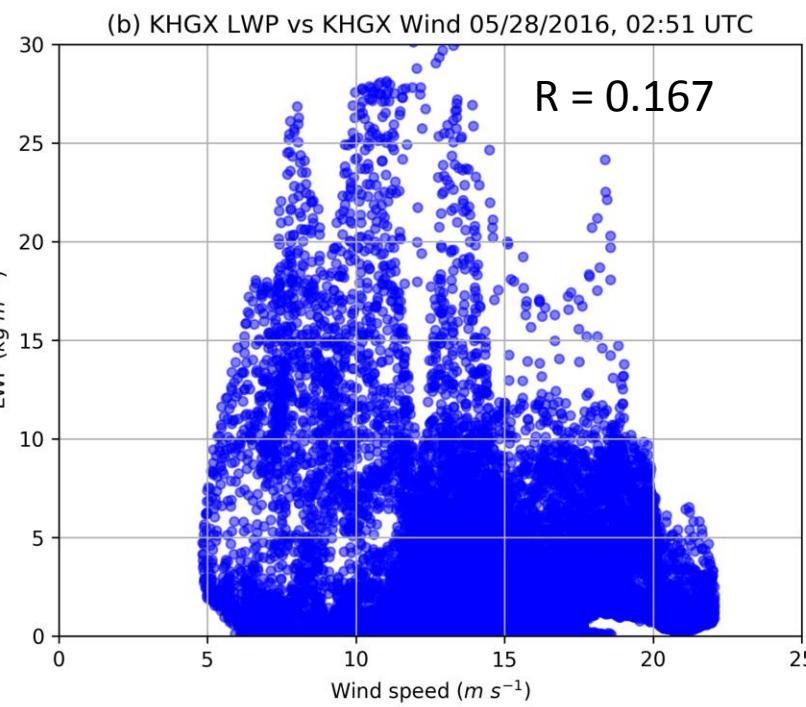
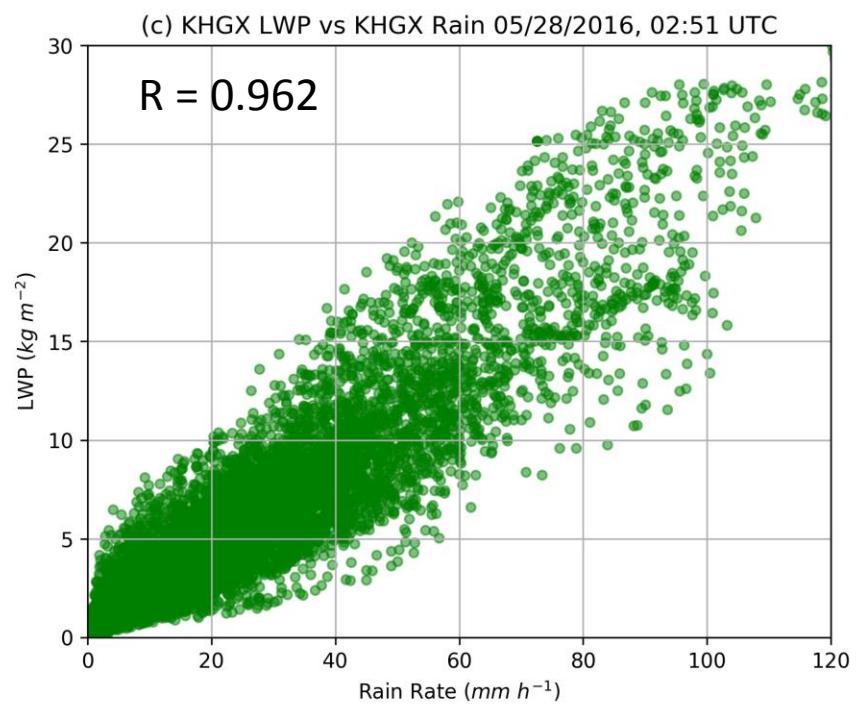
KHGX IWP vs. ASCAT-A

Resampled to 2-km

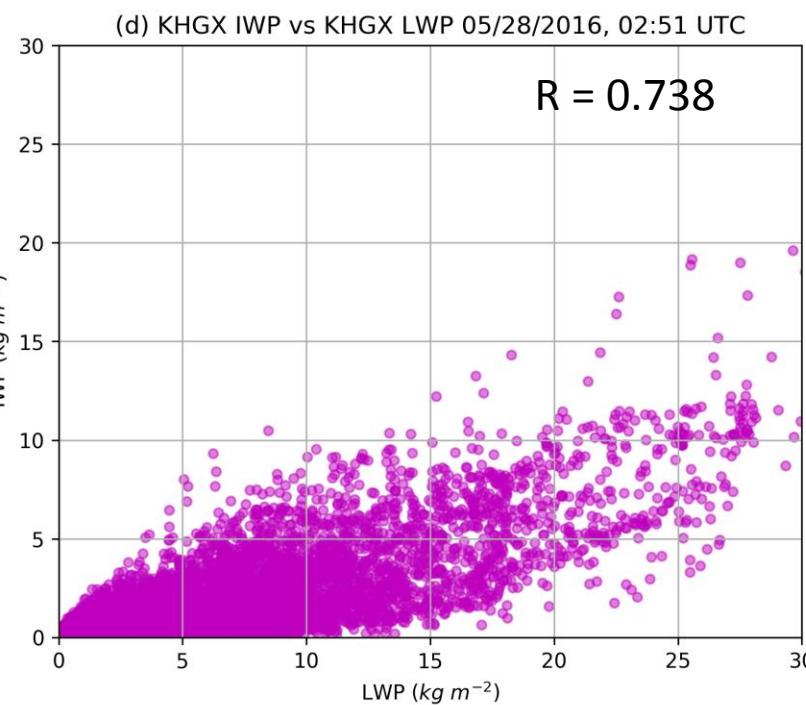
KHGX Rain vs. KHGX Wind



KHGX LWP vs. KHGX Rain



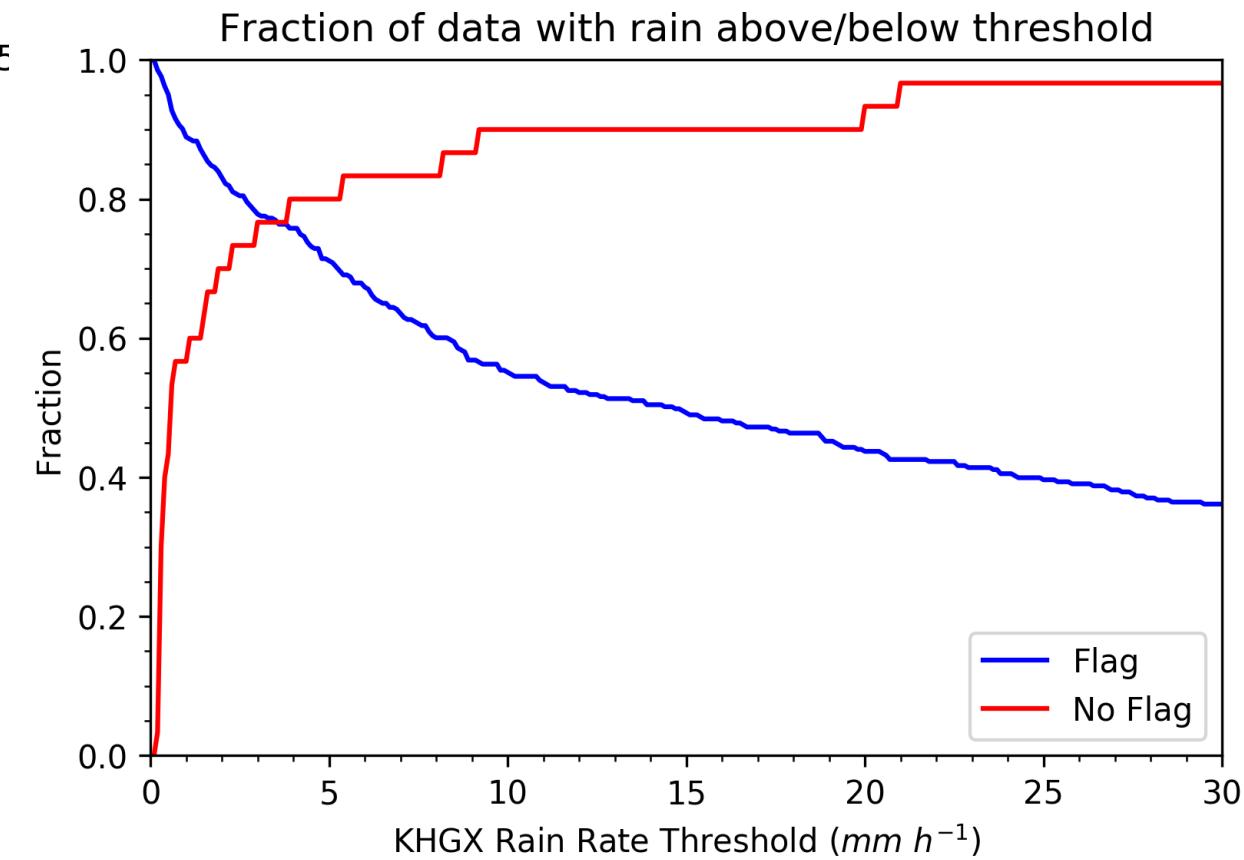
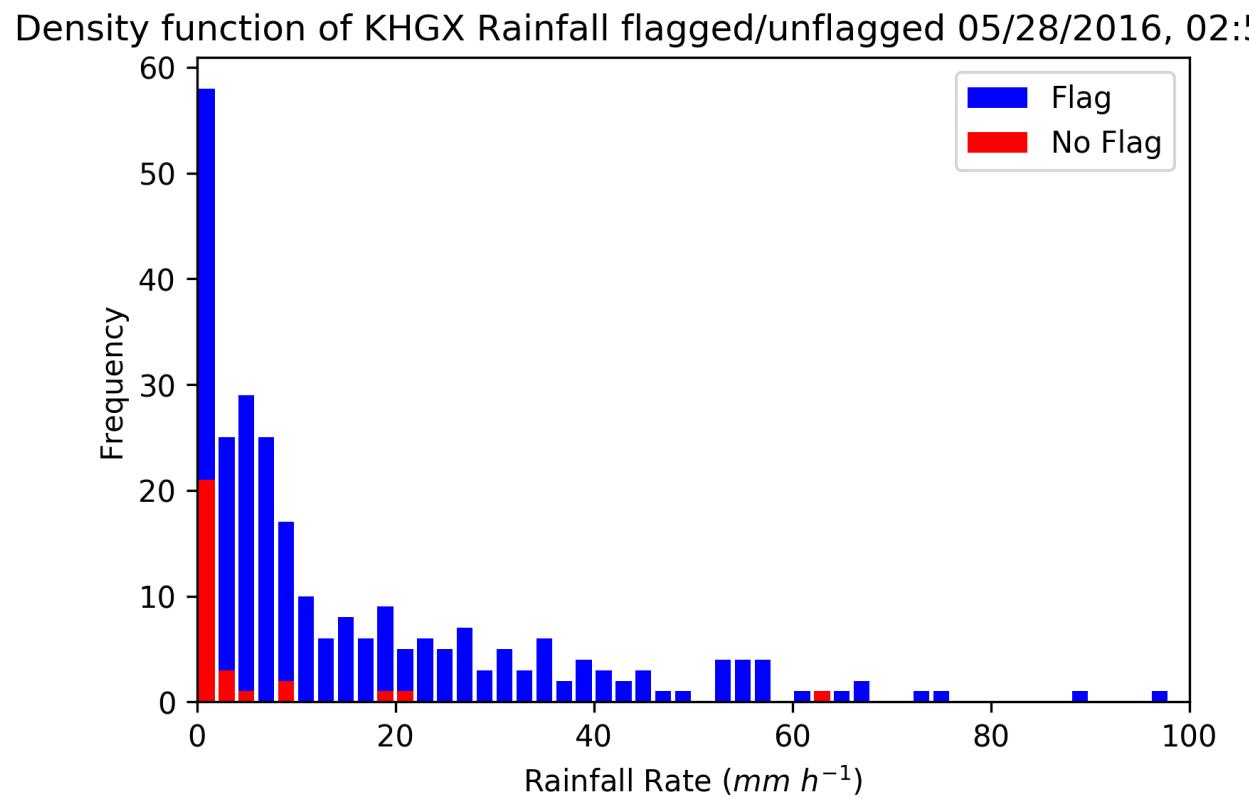
KHGX LWP vs. KHGX Wind



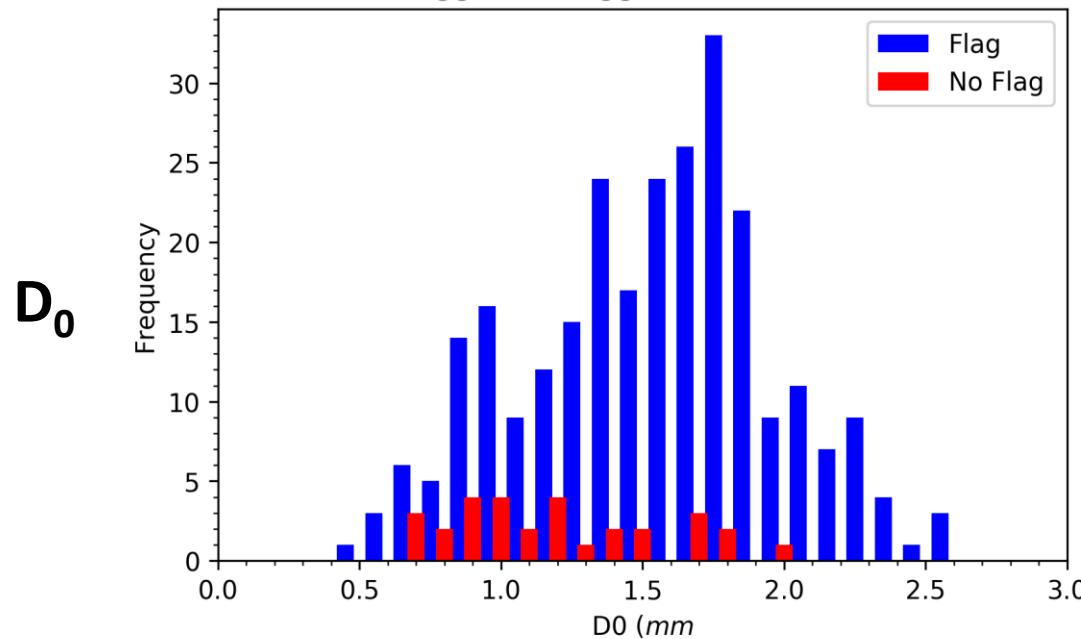
KHGX IWP vs. KHGX LWP

At a threshold of 3 mm h^{-1} :

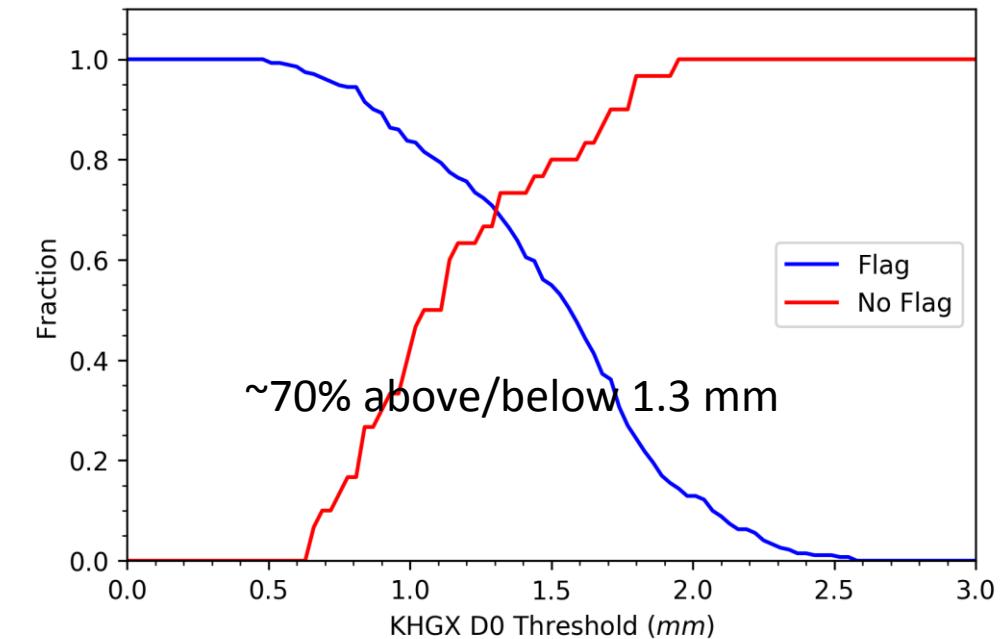
- ~75% of flagged data are above
- ~75% of unflagged data are below



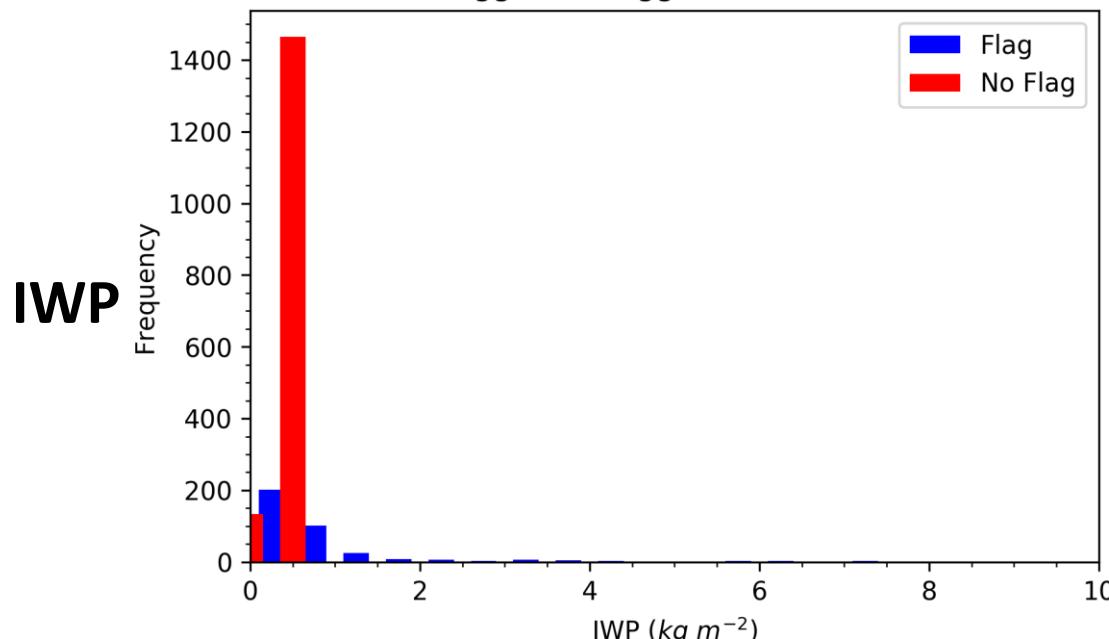
KHGX D0 flagged/unflagged 05/28/2016, 02:51 UTC



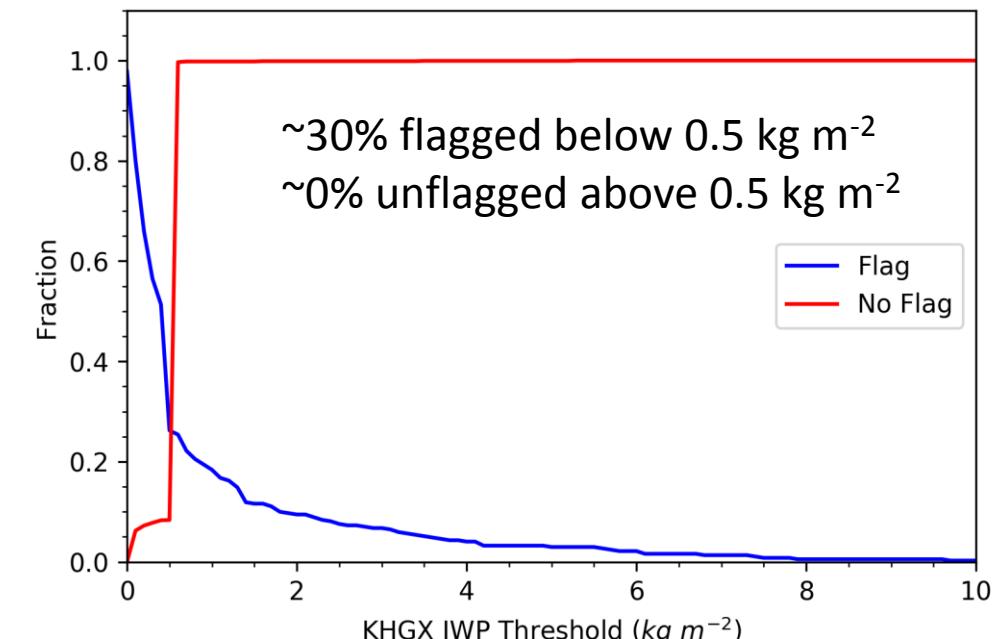
Fraction of data with D0 above/below threshold



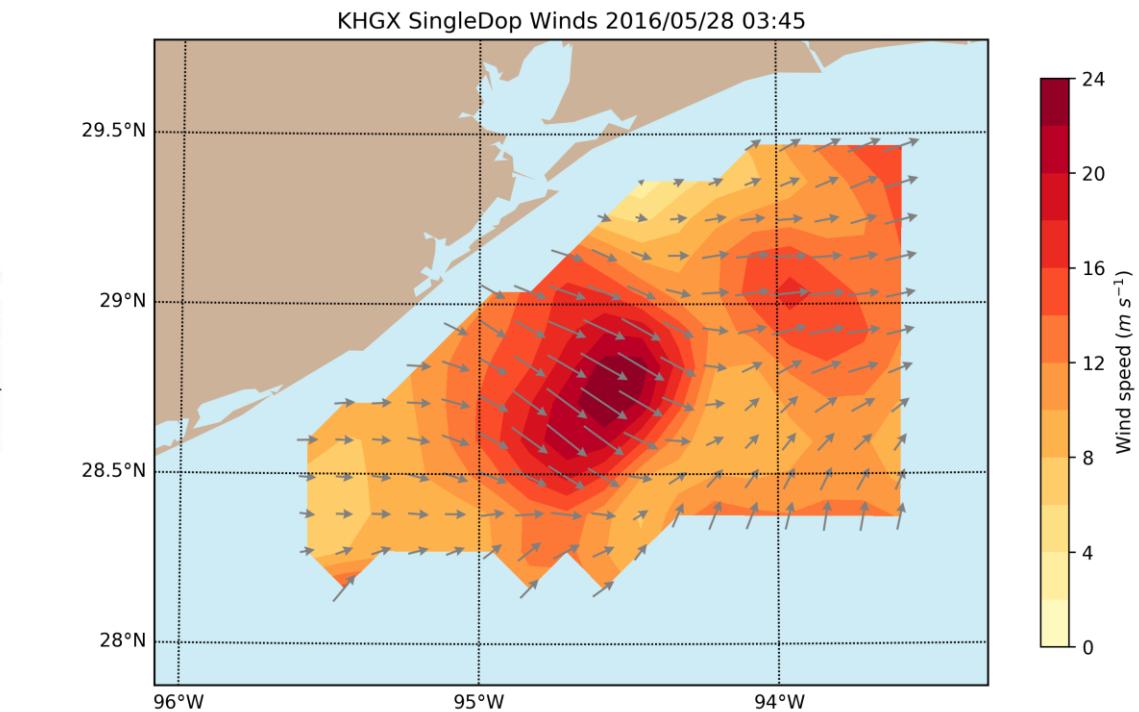
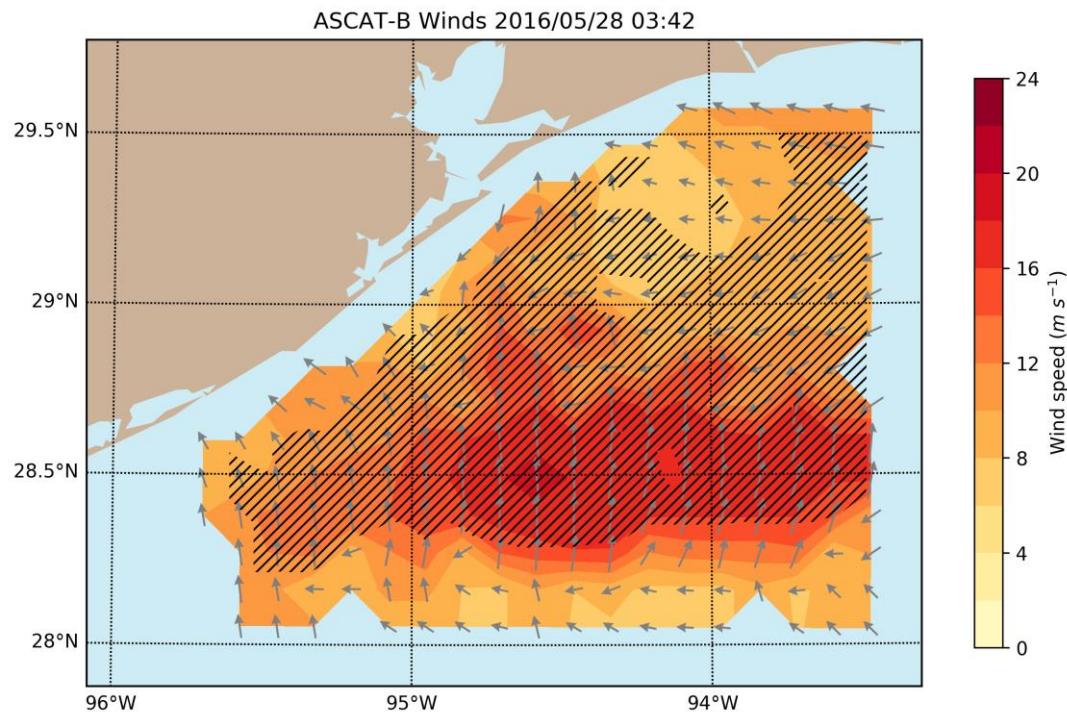
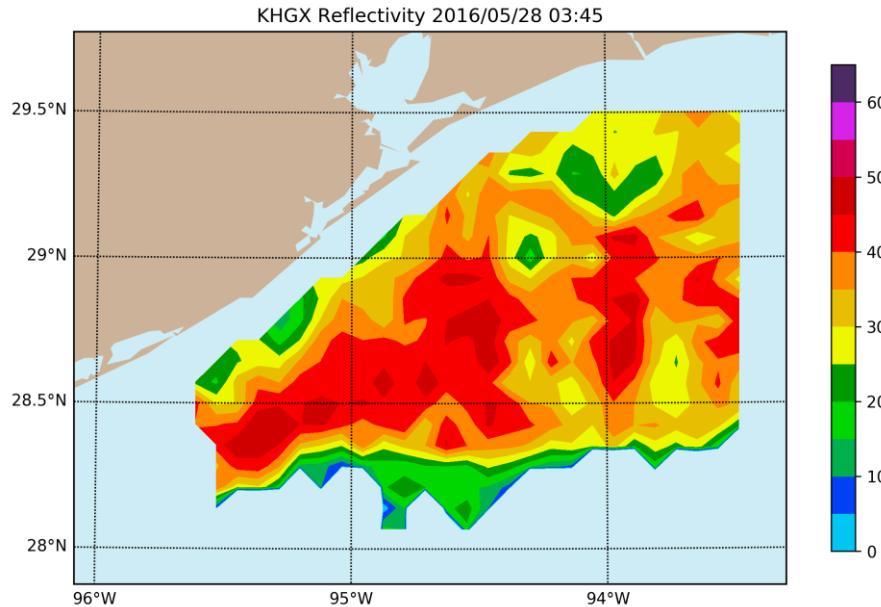
KHGX IWP flagged/unflagged 05/28/2016, 02:51 UTC

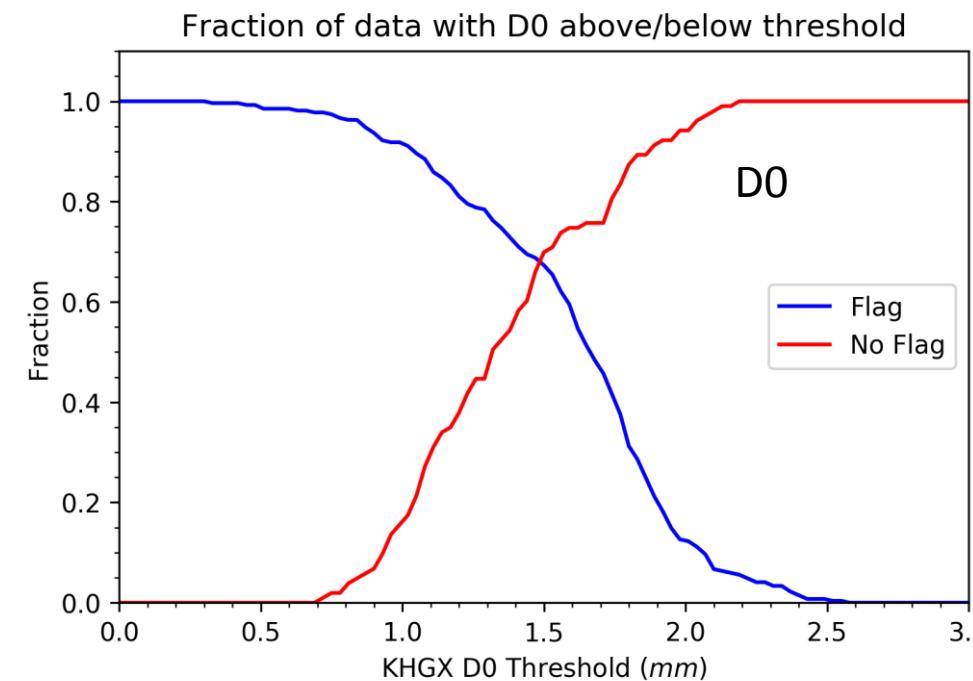
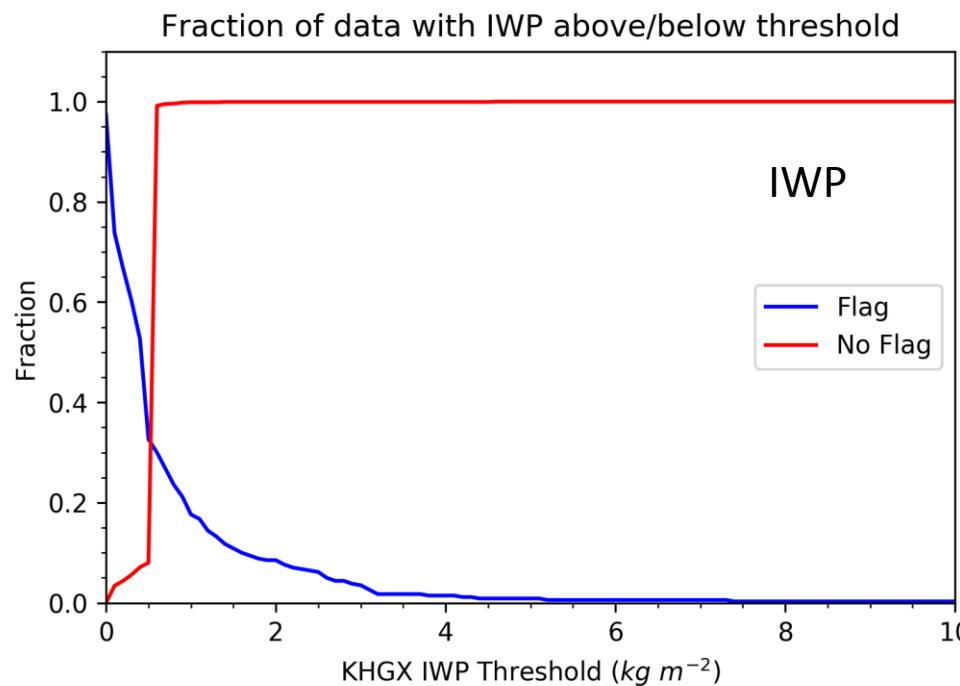
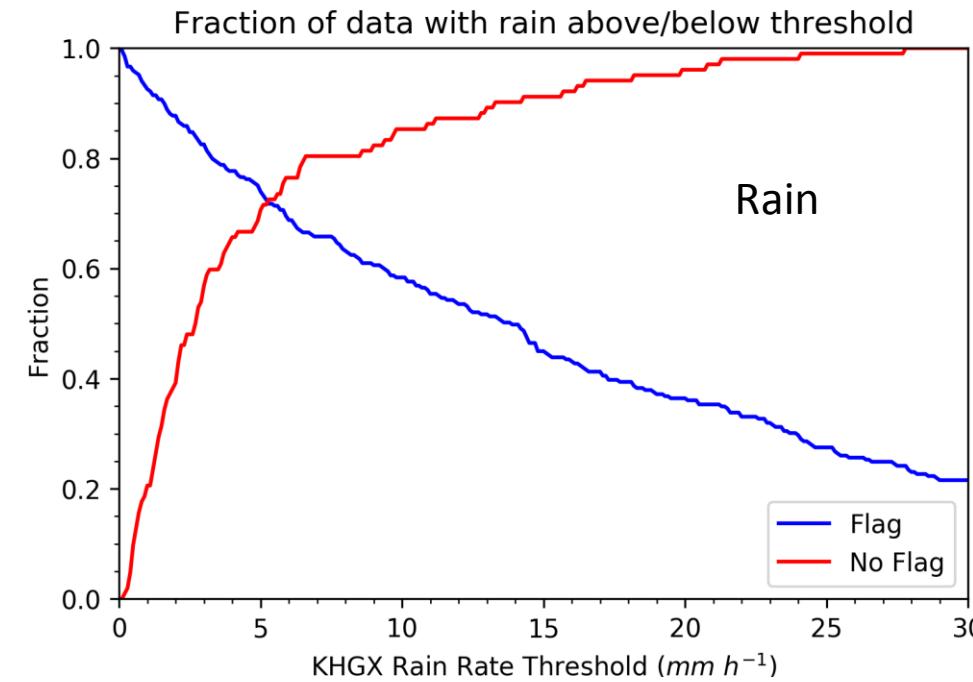
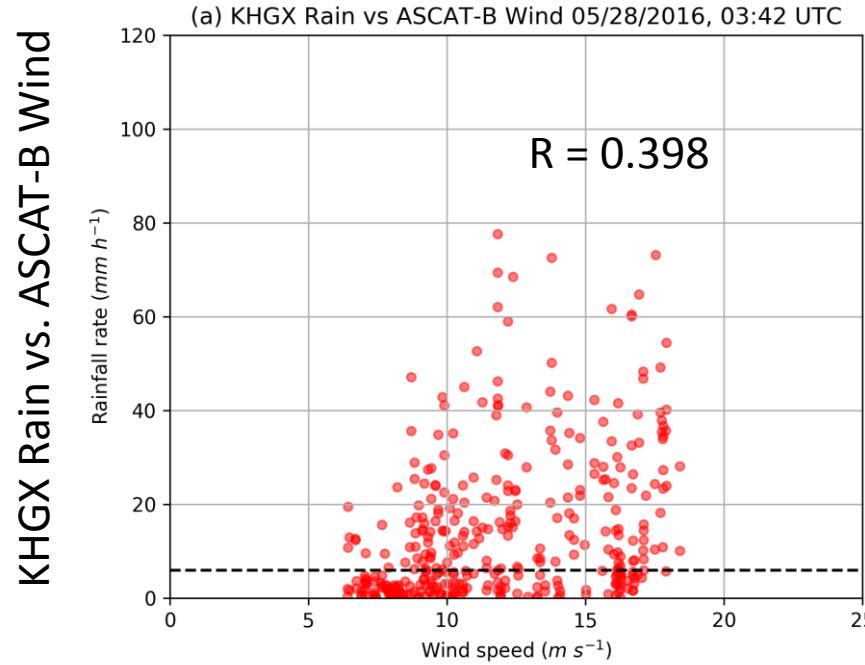


Fraction of data with IWP above/below threshold

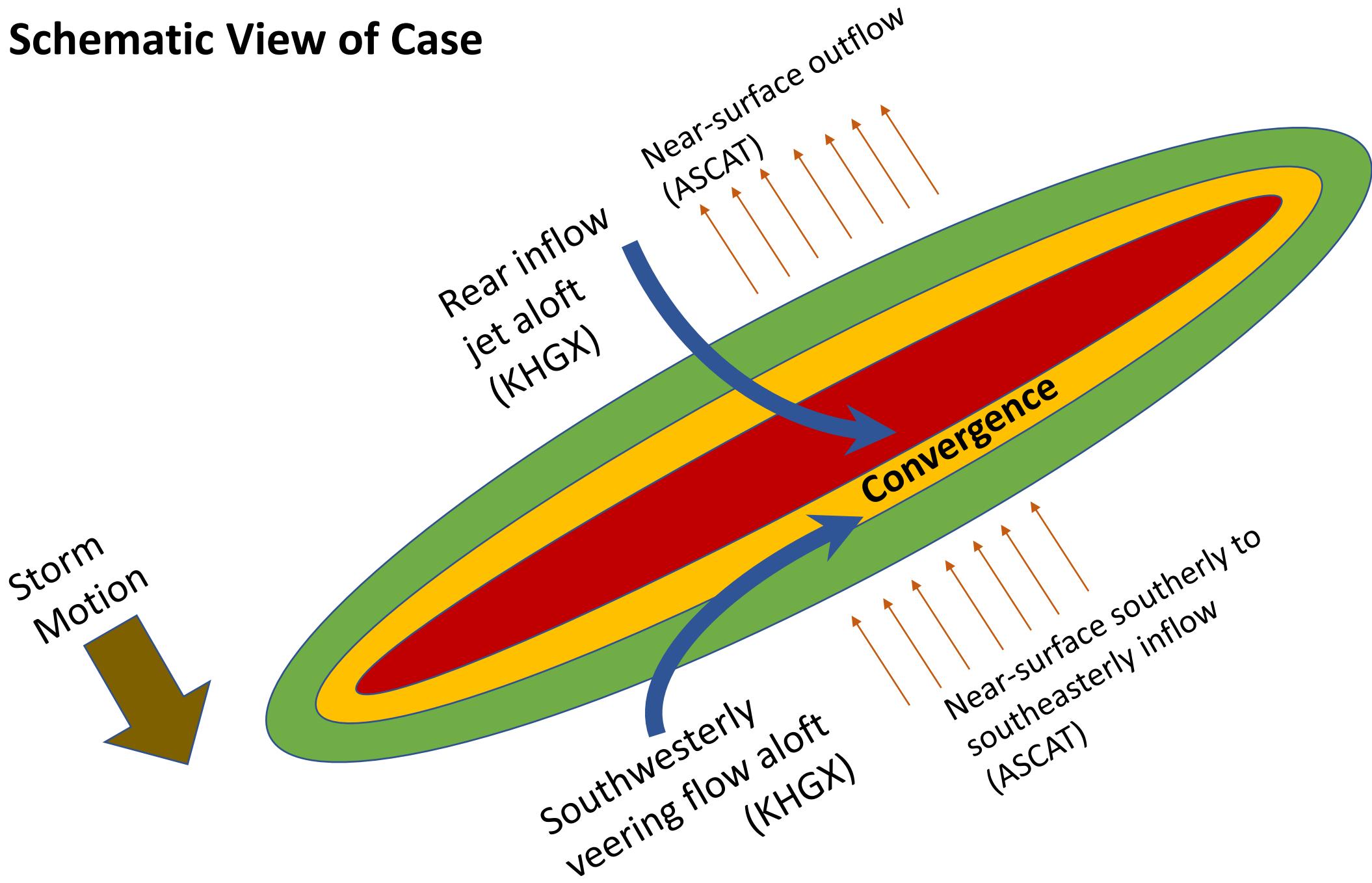


ASCAT-B Overpass 0342 UTC



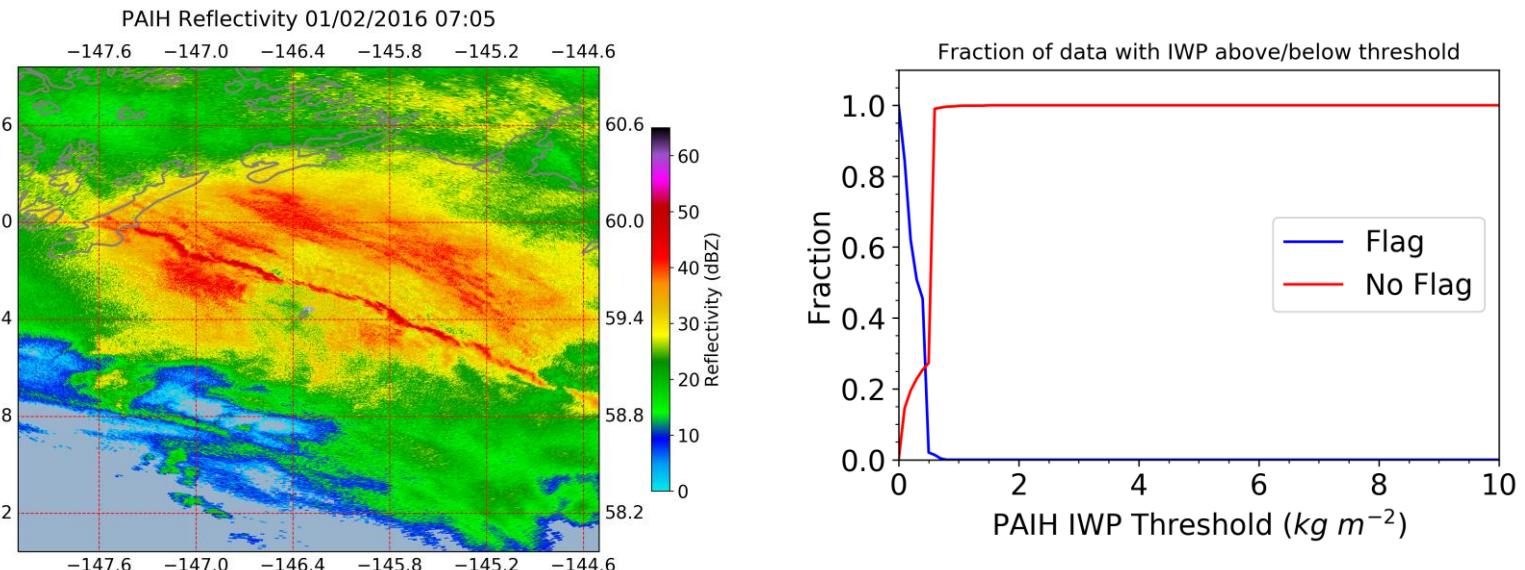


Schematic View of Case

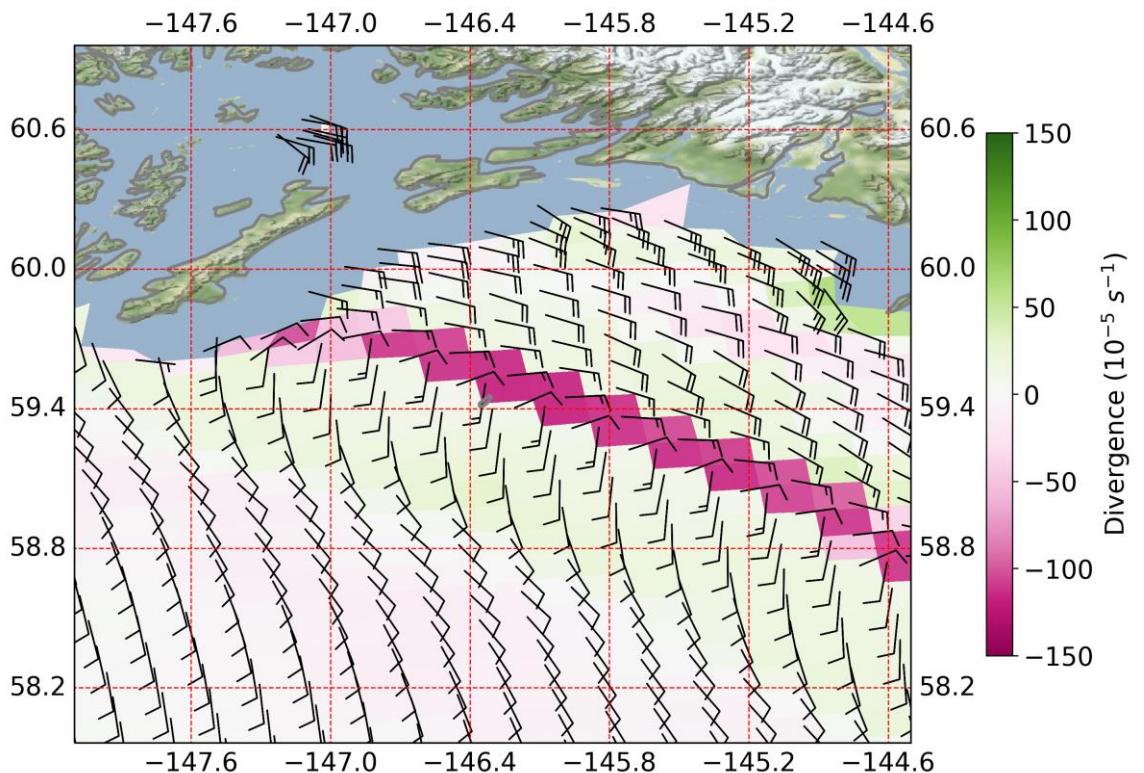


Quick look at another case (we have many!)

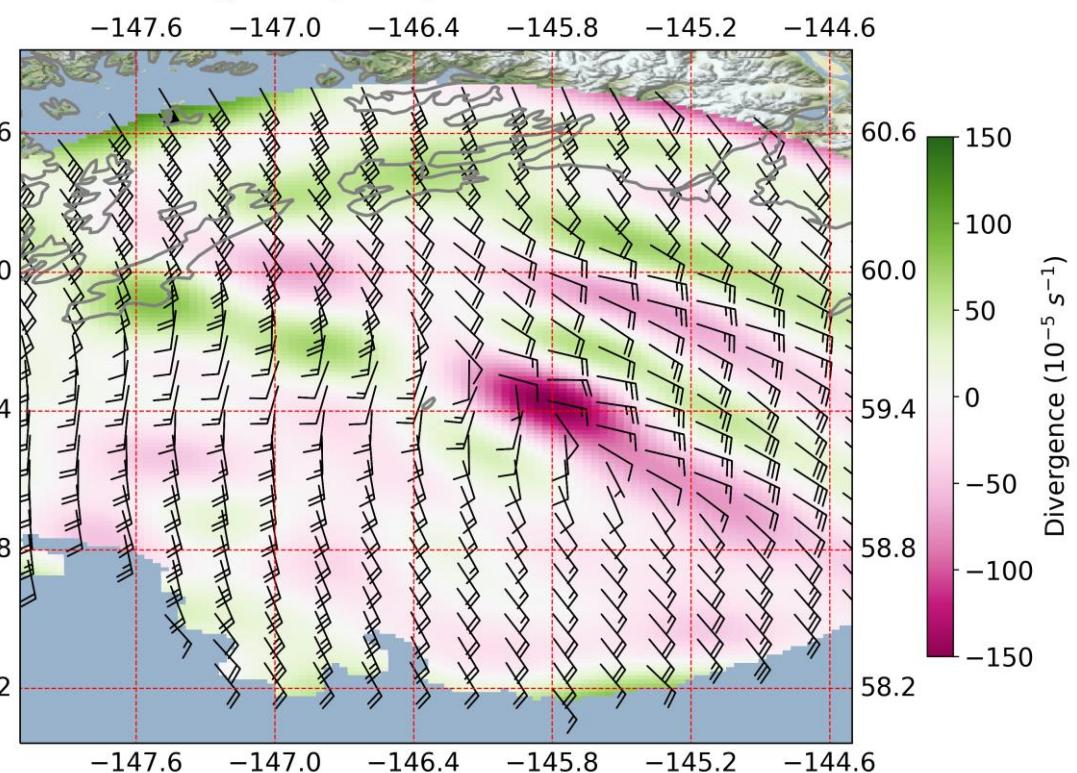
1/2/2016 near Alaska



Divergence (ASCAT-A) 01/02/2016 06:54



Divergence (PAIH) 01/02/2016 07:05



Summary

- Ground radar and scatterometer together provide an understanding of near-surface to low-level flow structures near organized convective systems
- ASCAT quality flags do not appear to correspond to consistent rain properties (e.g., rain rate, D_0 , LWP) – case/overpass dependent!
- However, if ASCAT quality flags are not set, that suggests low IWP ($< 0.5 \text{ kg m}^{-2}$) overhead

Questions? timothy.j.lang@nasa.gov